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Memorandum

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C.C. :			
FROM :	Anh-Long Nguyen	**REF. :**	678195-0000-30CX-0001, rev. 01
OBJECT :	Assessment of Water Balance and Water Quality Forecast around pond CP1 at Meliadine		

1.0 Introduction

Agnico Eagle Mine, Meliadine Mine ("AEM") submitted a Site Water Balance and Water Quality Model report (Golder 2020) to support the recent Type A Water Licence Amendment which includes a request to increase the discharge criteria for total dissolved solids (TDS). The submitted report represented a lower bound scenario that was not fully aligned with current monitoring data.

AEM has mandated SNC-Lavalin Inc. ("SNC-Lavalin") to provide an assessment of the lower bound model and to develop an upper bound model, based on 2019 and 2020 monitoring data, that forecasts the TDS upper bound concentration model in CP1 over the Life of Mine ("LOM"). This review and upper bound forecast focused on TDS only.

The following technical memorandum present the results of this assessment.

2.0 Reference Documents

Table 2-1 list the documents that were reviewed and used as part of this assessment.

Table 2-1 Reference Documents

Document	Document Number / File Name
Meliadine Site Water Balance Model	Golder updated model: Meliadine, Approved WB - Operations 2020 + Average Year
Meliadine Site Water Quality Forecast Model	2_WQM_LOM_Option E_1July2020_A3_RevB.xlsx
CP1 Water Elevation Monitored Data	Agnico Eagle Monitoring Data: Surface Pond Elevations 2020.xlsm, Elevation Readings
CP1 Water Quality Monitored Data	Agnico Eagle Monitoring Data: Surface_Pond_WQ.xlsx MEL-12-MEL14_2020 WQ.xlsx CPs WQ October 2020.xlsx
Daily Discharge Flows from CP1 to Meliadine Lake (via Water Treatment Plant)	Agnico Eagle Monitoring Data: DailyDischargeFlows_MEL-14.xlsx
CP2. CP3, CP4, CP5 Water Quality Monitored Data	Agnico Eagle Monitoring Data: Surface_Pond_WQ.xlsx
Meliadine Site Water Balance and Water Quality Model	Golder 2020. Meliadine Site Water Balance and Water Quality Model. 21 August 2020

3.0 Model Assessment

3.1 Water Balance

To assess the Meliadine Site Water Balance Model around pond CP1, a high-level water balance model was built around CP1 that considered the following:

- Source streams and estimated volume reporting to CP1 for the TDS upper bound model over the LOM;
- Monitored discharge volume from CP1 to Meliadine Lake that were reported for 2019 and 2020;
- Monitored transfer volumes from CP3, CP4, CP5 and CP6;
- Monitored CP1 pond elevation in 2019 and 2020.

The surface runoff volumes reporting directly to CP1 or via pumping from other sectors of the mine site, were then adjusted in 2019 and 2020 so that the forecasted water elevation in CP1 trends similarly to the monitored data.

This assessment revealed that the runoff volumes considered in 2019 in the TDS lower bound model were lower than what was observed on site. The TDS lower bound model considered an average precipitation while the precipitation data collected in 2019 indicated that it was a wet-year. An adjustment factor was used to calibrate the high-level water balance model results to the 2019 monitored water elevation.

For 2020, no adjustment was required. The runoff coefficient considered at the site were adjusted in the TDS upper bound model to match the trends observed in the monitored water elevation in CP1. Thus, the results from the model suggest that all source streams reporting to CP1 are properly considered in the updated model.

Figure 3-1 presents the monitored and forecasted pond elevation in CP1 considering the adjusted runoff volumes in 2019 and 2020 and assuming an average precipitation over the Life of Mine from 2021 to 2028.

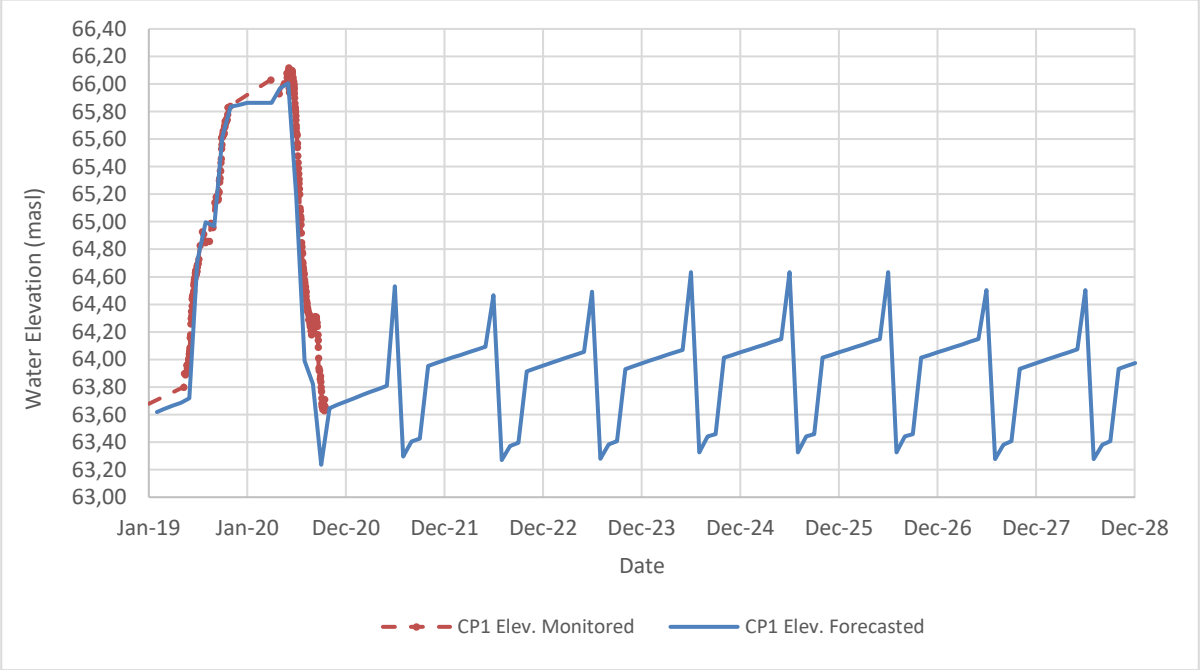

Figure 3-1: Monitored and Adjusted Forecast Water Elevation in CP1 over the LOM

3.2 Water Quality Forecast

To assess the Meliadine Site Water Quality Forecast Model around pond CP1, using the high-level water balance model described in Section 3.1, a high-level TDS upper bound mass balance model was built around CP1 that considered the following:

- Source streams TDS concentration for each stream reporting to CP1 that were considered in the TDS upper bound model over the LOM. The updated model considers a higher TDS loads than the lower bound model, specifically from disturbed area around the site (i.e. WRSF, site, etc) and from the Tailing Storage Facility;
- Monitored TDS concentration in CP1 from 2019 and 2020.

The TDS lower bound model did not consider cryo-concentration in CP1 over the winter months due to the formation of an ice sheet. Using the monitored TDS data in CP1 over the winter months from 2019 to 2020, the ice sheet thickness was adjusted to calibrate the forecasted TDS concentration to the monitored data. For the rest of the LOM, the ice sheet thickness is calculated assuming a minimum of approximately 1000 m^3 of free water remains in CP1 in the winter.

Figure 3-2 presents the monitored and forecasted pond TDS concentration in CP1 over the LOM based on the TDS upper bound model developed for this assessment. The TDS lower bound forecasted values are also presented. Vertical lines are shown to indicate the start and end of the treatment and discharge period (June to October).

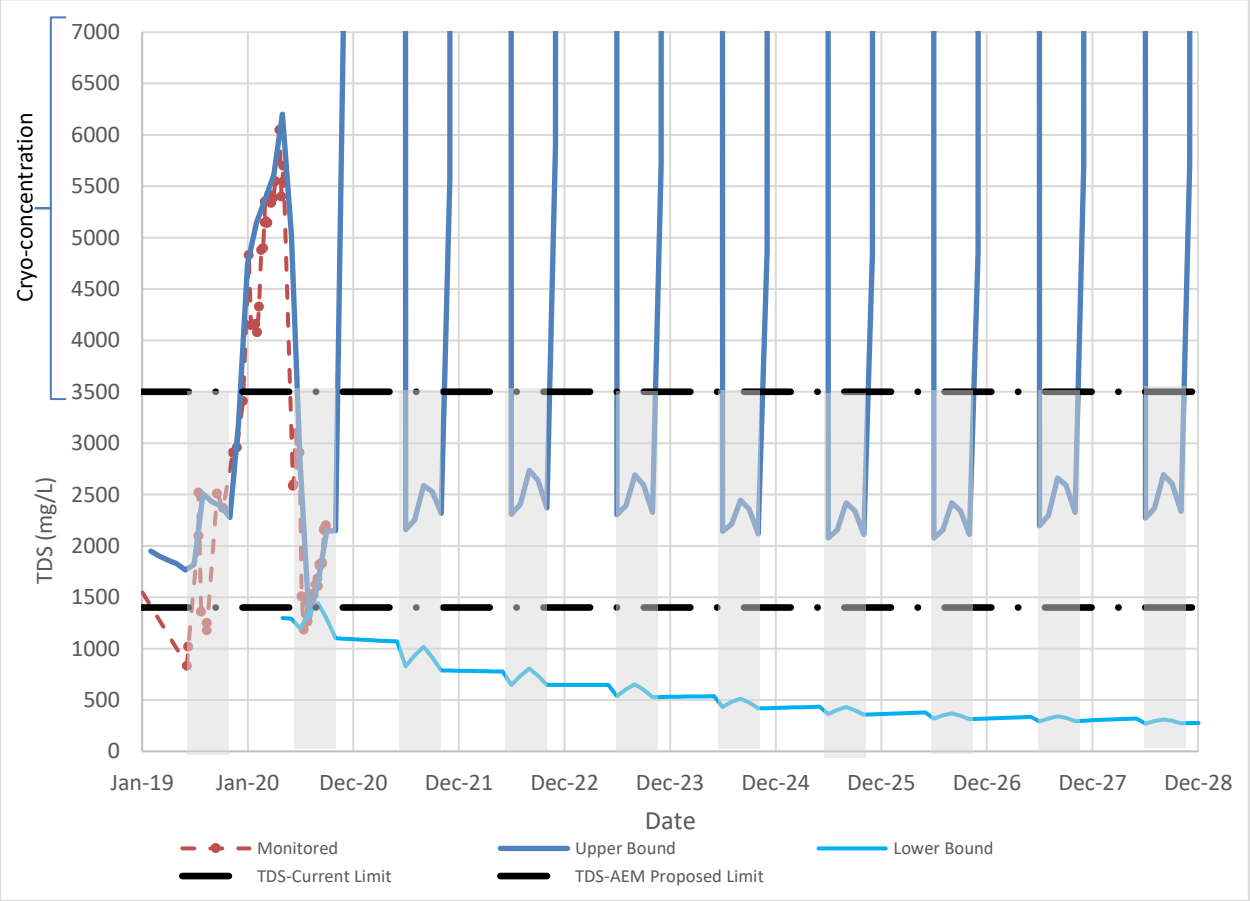

Figure 3-2: Monitored and Forecast TDS in CP1 over the LOM

The findings from the assessment of the lower bound Water Quality Forecast, and the new upper bound Water Quality Forecast, as shown in Figure 3-2, are the following:

- Forecasted TDS modelled in the upper bound scenario follow a similar trend to the monitored data when compared to the TDS lower bound model by accounting for a higher TDS load coming from the different sectors of the mine site and the tailings storage facility.
- The TDS upper bound model was able to forecast a higher TDS concentration in September and October 2020 that trends similarly to the monitored data by considering the monitored data measured in CP3, CP4, CP5 and CP6 ponds.
- The TDS upper bound model considers cryo-concentration due to the formation of an ice sheet that reduces the free volume in the pond over the winter months. TDS concentration are expected to increase over the winter months and then decrease once the ice sheet starts melting in June.
- When considering the higher TDS load that could report to CP1 from runoff collected from other sectors of the mine site, the forecasted TDS concentration in CP1 during the summer months is forecasted to fluctuate around 2000 to 2500 mg/L. This forecasted concentration is higher than the current TDS discharge limit of 1400 mg/L.
- Table 3-1 summarizes the estimated TDS load from ponds CP3, CP4, CP5 and CP6, and the rest of the site (i.e. TSF, landfarm, ore pad, landfill, catchment area around CP1, P-Areas) to CP1 in 2019 and 2020. The TDS loads were calculated from the monthly average monitored TDS concentrations in the CP ponds, assumed TDS concentrations from other sectors of the site and the estimated transferred volumes. Based on this assessment, the following can be observed:
    - 2019 was a wet-year and consequently a higher TDS load was assessed reporting to CP1. This data suggest that the higher runoff volume was flushing out accumulated salts contained in the pore water in the WRSF, the TSF and other sectors on the site;
    - 2020 was a dryer year, and thus a lower TDS load to CP1 was assessed. The TDS loads from CP3, CP4, CP5 and CP6 ponds represents in total about 60% of the total TDS load reporting to CP1.
    - For the rest of the LOM, assuming an average precipitation year, it is forecasted that CP2, CP3, CP4 CP5 and CP6 ponds shall continue to contribute about 60% of the TDS load to CP1.

AEM is currently requesting the authorities to consider a higher TDS discharge limit of 3500 mg/L. Based on the forecasted TDS over the LOM, the TDS in CP1 could vary within the forecasted model for TDS lower and upper bounds as shown in Figure 3-2.

Table 3-1 Estimated TDS Loads from CP3, CP4, CP5 and CP6 Ponds in 2019 and 2020

Year	Month	TDS Load to CP1 (t)					
		Rest of Site	CP4	CP3	CP5 (Note 1)	CP6	Sub-Total
2019	June	273	12	12	156	0	**453**
	July	408	17	6	0	0	**432**
	August	97	0	39	0	0	**136**
	September	583	59	44	0	0	**685**
	October	47	0	0	31	0	**78**
2019	**Total**	**1 408**	**88**	**101**	**187**	**0**	**1 785**
2020	June	12	10	13	31	2	**68**
	July	19	5	17	100	7	**148**
	August	68	13	30	0	32	**143**
	September	191	42	34	37	31	**335**
	October	84	32	28	0	20	**163**
2020	**Total**	**373**	**101**	**123**	**168**	**92**	**857**

Note 1: Water from CP5 can be transferred either to CP1 or to a Reverse Osmosis (RO) treatment system. The TDS loading values shown in the table are the net TDS transferred from CP5 to CP1.

In 2019, a total volume of 157 074 m^3 of water was pumped out of CP5, representing a total TDS load of about 668 t. 70% of this volume and 79% of the TDS load was treated by an RO unit while the balance was transferred to CP1. In 2020, a total volume of 96 879 m^3 and a TDS load of about 243 t was pumped out of CP5. 84% of this volume and 69% of the TDS load was transferred to CP1.

4.0 Conclusions

An assessment of the TDS lower bound model Water Balance and Water Quality Forecast models at the Meliadine Site, and development of an upper bound model, was undertaken.

All of the source streams were considered in the lower and upper bound model and the water balance was calibrated based on monitored water elevation and volume transferred from CP1. The TDS upper bound model provides forecasted TDS based on the monitoring data, water storage and movement on the site, and mine development plans (e.g., future placement of wasterock).